

# LOW POWER EMBEDDED SYSTEM FOR HUMAN FALL DETECTION APPLICATION

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## ABSTRACT

Fall detection is a major challenge in the world. Fall leads to many serious medical problems, physical disabilities. Most of the elderly people were suffered from the falls. This make researches to find automatic monitoring system for detecting the falls when it occurs. Lots of the efforts had successfully achieved a hardware system to provide a fall pattern before or after fall. Many of the fall death occurs because the victim remains stable on the ground for long hour. It can affects ones mental health and isolation. The existing detection systems are still deficient in power optimization. This paper develops a fall novel detection and stable movement detection system based on a wearable device .The sensor used to detect the position of the person and given as input to the system. If person position beyond the critical value in the xyz direction, the system detects that fall occurs. The message send to the care taker via cellular network. The stable movement detection also provide information about abnormal position to normal position of the body by voice alert messages. This paper is based on the Euclidean distance algorithm. This paper is normally is in sleep mode, whenever the fall occurs the system becomes active and the buzzer alarm triggered. And this system also indicates the location of the patients, which are in need of help.

## INTRODUCTION

Embedded System is a combination of hardware and software used to achieve a specific task. And it is a microcontroller-based, software driven, real-time control system, autonomous, or human or network interactive, operating in diverse physical variables and environments. In order to provide better living for them, it is important to have continuous human monitoring systems in their home to inform the health care representatives of any emergency attendance.falls can be classified in to many types. They are fall from sleeping, fall from sitting,

Climbing on the ladder etc. this paper is useful for the disabled, obese and overweight people. Falls can be result in serious medical injuries, loss of self-confidence and for treatments medical cost can be high. Lots of people above 65 are suffered from serious injuries.

Medical cost for fall injuries can be ranging from \$36 billion to \$37 billion in the previous years. The proposed system gives the emergency

notification to the care taker and the location also. This system monitors the user balanced and unbalanced states. If the unbalance state is detected, buzzer can be triggered and the emergency notification can be intimate to the caretaker within milliseconds. Existing systems are using the accelerometer, gyroscopes, pressure sensors and cameras. Power efficiency is high in the existing system. The advantages of this system are accurate, live monitoring and extra care will be provided. And it can be also used in children tracking. It can be used in military and aerospace embedded software applications.

Existing system has the power issue.in this system it is having three axis sensors. X axis sensor, y axis sensor and z axis sensor. X axis sensor is used to measure the x position i.e. the horizontal position of the object. Y axis sensor is used to measure the y position i.e. the vertical position of the object. Z axis sensor is used to measure both the directions. And position sensors can be used for to detect the position of the objects. It consists of pic16f877a microcontroller and a

MEMS sensor. Once the sensors are initialized, we have to check the user's current state. If the user is in normal mode then place the picmicrocontroller in deep sleep mode. When the acceleration is in above threshold for the given time, it sends the interrupt request to the microcontroller.

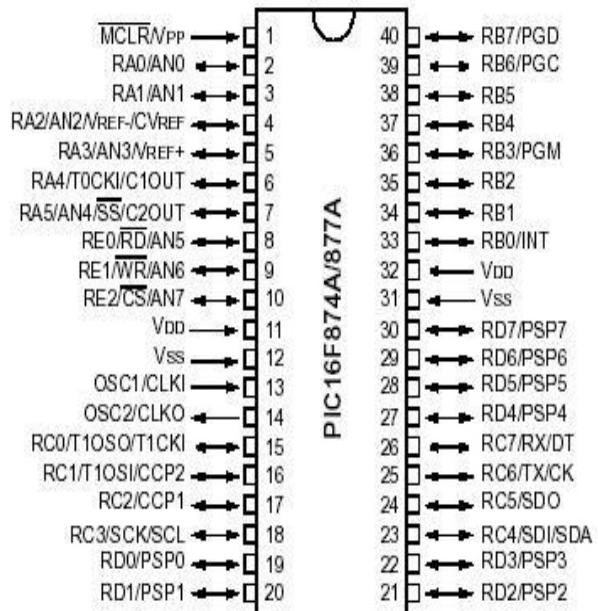
## LITERATURE SURVEY

The existing system was based on the wearable air bag, which having a prototype airbag system. The patients has to wear the air bag, in all time.it is insufficient to the people who are wearing and is high cost and errors can be occurred during false errors and free fall condition before angular velocity.it uses both acceleration and the angular velocity. Neeraj rathi and ashok Kumar thella published a paper pre fall detection .in this paper preventing from fall accidents is an issue and power issue. Prevention from fall is not possible, but protecting from fall can be possible. Shan et al using a machine learning algorithm which is too complex. Rahul Tiwari and atul Kumar Singh developed a paper on android platform, which is very cost effective.it has complex machine learning applications. Lots of people can be suffered from pains and lead to death also. And another system is based on acoustic fall detecting system which is having high cost of components.

## PROPOSED SYSTEM

This paper has to improve the sensitivity and specificity with minimum number of sensors. These sensors can be kept in chest, waist and sacral. Initially three axis sensors can be used. We are using pic16f877a microcontroller with 40 pins. PIC means peripheral interface controller. The PIC family is having different series. They are 12 –series, 14- series, 16- series, 18-series and 24- series. In this paper we use 16-series microcontroller. It has been used for gathering input from various sensors and processing these input to the set of actions. Here, RAM and ROM are already in build and also cheap compared to the microprocessor. In the microcontroller, 33 pins can be connected the I/O port. And it having 5 ports, they are port A, port B, port C, port D and port E . Port A has 6 pins, port B, C, D are having 8 pins and port E is having 3 pins. Port d is in build to the LCD. The operating speed of microcontroller is 20 MHz with clock input of 200ns. It has the operating voltage of 2v to 5.5 v with 8k\*14 word flash – program memory, 368\*8 bytes of data memory (RAM), 256\*8 bytes of EEPROM data memory. It has an eight level deep hardware stack with interrupt capability. Varied from commercial and industrial temperature ranges.

## PIN DIAGRAM:

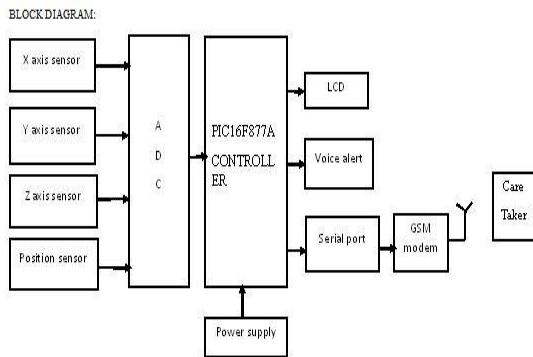


Here, theOSC1/CLK1 is the Oscillator crystal or external clock input, OSC2/CLK0 Oscillator crystal or clock output, MCLR is the master clear input. When the peripheral is enabled it cannot be used as I/O pin. Port A is 16 bit wide and it is bidirectional, bidirectional, this port can wake the device from sleep mode. , port D is 8 bit port with Schmitt trigger input buffer. Each pin can be individually configured in this. Port E has three pins (RE0/RD/AN5, RE1/WR/AN6 and RE2/CS/AN7). There are three memory blocks in this picmicrocontroller. They are the program memory, data memory and the EEPROM data memory.it has a 13 bit program counter also.

Here, bridge rectifier is using because of good stability and full wave rectification. The rectifier converts the A.C in to the pulsating D.C. then the capacitive filter is used. From the output of rectifier, it smoothes the D.C output. Voltage regulator regulates the input applied to it. It automatically maintains the constant voltage level. Here, 5v- 12v power supply can be required. We are using ADXL335 triple axis MEMS accelerometer with low noise and low power consumption. It has including 0.1 microfarad capacitor and bandwidth of 50 Hz. Sensing range of sensor can be ranging from 3g and the bandwidth is ranging from 50 Hz.

The operating voltage of the LCD is 3.3 volts and the crystal oscillator is the heart of the system with 20 mhz. LCD is having totally 16 pins

which are being 8 data pins and 3 RS, RW, Enable pins. LCD is having 4 bit or 8 bit interface. It is a standard type which is having great value pricing which can be work with almost any microcontroller. And this system is having the MAX232 IC with 8 channels analog to digital convertor (ADC) can be in build in to the GSM modem is a special type of modem which is having a sim card, which operates like a mobile phone to the operator.



From the block diagram, x axis sensor is used to measure the x position i.e. the horizontal position of the human, y axis sensor is used to measure the vertical position i.e. the vertical position of the body and z axis sensor is used to measure both the directions of the body. They are given to the analog to digital converter.the controller accepts only the digital values so they are converted to digital values. Accelerometer can measure acceleration in one or two or three accelerometer axes. They are dynamic sensors. Most of the accelerometers are micro electro mechanical sensors. There are different types of accelerometers. They are null balance, servo force balance, resonance, strain gauge and optical. They have dynamic range, bandwidth and amplitude stability here, analog accelerometers are usually preferred.

These values are given to a controller. And the power supply is given to the system. The controller can be connected via the serial port to the GSM. Serial port can provide the serial communication in the peripherals.it connects the controller and the GSM modem.it intimate to the car taker via the GSM modem and it also displayed in LCD via the location also. Another, feature included in this paper is the position detection. Whenever working in straight or working in a computer we can suffer from back pain or any other aches. So, position sensor can be fixed to the controller. It can intimate the human with the voice alert to change the position.

These are fixed to the elders or the patients who need help with the MEMS sensors. If the position beyond the critical value is high, the body

is in normal mode. If the threshold is low the body is in abnormal position, the x, y, and z values can be varied according to the position in these axis. The changes in the human body were walking downstairs, walking upstairs, sitting down and standing up in the chair. The acceleration will not change drastically to the elders but the acceleration during the fall can be varied. The components used in the proposed system are very low cost and more convenient .these components were simulated through certain software with the help of MP Lab IDE and pickit 3 Programmer and with the embedded C.

## CONCLUSION

Falls are become serious now a days. People are seriously suffer from falls when they fall in different falls, whenever their fall are not identified. This paper is very useful for the elderly people. This paper can reduce the medical costs for the fall injuries.in the previous year's fall has been a serious



Problem. But this paper is accurate and can be lively monitoring and extra care can be provided. It can be also used in children tracking also. When the children are missing, they can find out with the help of the system. Also useful in hospitals.

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